

# Bis[ $\mu$ -*N*-(pyridin-2-ylmethyl)pyridin-3-amine- $\kappa^2$ N:N']disilver(I) bis(perchlorate) dimethyl sulfoxide disolvate

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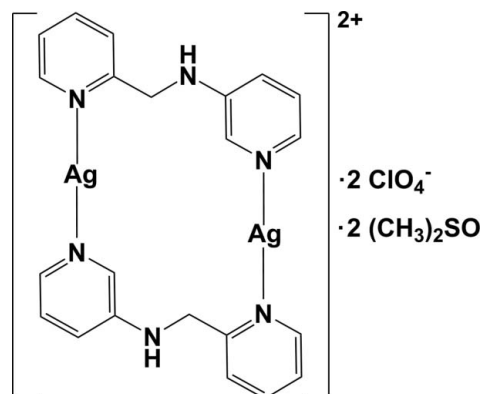
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Key indicators: single-crystal X-ray study;  $T = 173$  K; mean  $\sigma(\text{C}-\text{C}) = 0.005$  Å;  $R$  factor = 0.033;  $wR$  factor = 0.086; data-to-parameter ratio = 15.5.

In the binuclear title compound,  $[\text{Ag}_2(\text{C}_{11}\text{H}_{11}\text{N}_3)_2](\text{ClO}_4)_2 \cdot 2\text{C}_2\text{H}_6\text{SO}$ , the complex cation is centrosymmetric, with the unique  $\text{Ag}^{\text{I}}$  cation coordinated by two pyridine N atoms from two symmetry-related *N*-(pyridine-2-ylmethyl)pyridine-3-amine ligands in a geometry slightly distorted from linear [ $\text{N}-\text{Ag}-\text{N} = 170.78$  (9)°], resulting in the formation of a 16-membered cyclic dimer. The two pyridine rings coordinating to the  $\text{Ag}^{\text{I}}$  atom are almost perpendicular to each other [dihedral angle = 87.73 (10)°]. Intermolecular  $\text{Ag} \cdots \text{O}$  interactions [3.149 (3) and 2.686 (3) Å],  $\text{N}-\text{H} \cdots \text{O}$  and  $\text{C}-\text{H} \cdots \text{O}$  hydrogen bonds and  $\text{C}-\text{H} \cdots \pi$  interactions between the cyclic dimers and the anions or the solvent molecules lead to the formation of a three-dimensional supramolecular network.

## Related literature

For structures of  $\text{Ag}^{\text{I}}$  coordination polymers with symmetrical dipyridyl ligands, see: Lee *et al.* (2012); Leong & Vittal (2011); Park *et al.* (2010) and of  $\text{Ag}^{\text{I}}$  coordination polymers with unsymmetrical dipyridyl ligands, see: Moon & Park (2013); Zhang *et al.* (2013). For the synthesis of the ligand, see: Foxon *et al.* (2002); Lee *et al.* (2008).



## Experimental

### Crystal data

$[\text{Ag}_2(\text{C}_{11}\text{H}_{11}\text{N}_3)_2](\text{ClO}_4)_2 \cdot 2\text{C}_2\text{H}_6\text{OS}$   
 $M_r = 941.35$   
 Monoclinic,  $P2_1/c$   
 $a = 7.3620$  (3) Å  
 $b = 11.1227$  (5) Å  
 $c = 21.1248$  (10) Å  
 $\beta = 95.328$  (1)°  
 $V = 1722.34$  (13) Å<sup>3</sup>  
 $Z = 2$   
 Mo  $K\alpha$  radiation  
 $\mu = 1.48$  mm<sup>-1</sup>  
 $T = 173$  K  
 $0.45 \times 0.20 \times 0.20$  mm

### Data collection

Bruker SMART CCD area-detector  
 diffractometer  
 9537 measured reflections  
 3367 independent reflections  
 3096 reflections with  $I > 2\sigma(I)$   
 $R_{\text{int}} = 0.049$

### Refinement

$R[F^2 > 2\sigma(F^2)] = 0.033$   
 $wR(F^2) = 0.086$   
 $S = 1.02$   
 3367 reflections  
 217 parameters  
 H-atom parameters constrained  
 $\Delta\rho_{\text{max}} = 0.61$  e Å<sup>-3</sup>  
 $\Delta\rho_{\text{min}} = -0.65$  e Å<sup>-3</sup>

**Table 1**

Hydrogen-bond geometry (Å, °).

$C_g$  is the centroid of the N2/C7–C11 pyridine ring.

$D-H \cdots A$	$D-H$	$H \cdots A$	$D \cdots A$	$D-H \cdots A$
$\text{N3}-\text{H3} \cdots \text{O1}$	0.88	2.32	3.081 (4)	144
$\text{C1}-\text{H1} \cdots \text{O2}^{\text{i}}$	0.95	2.56	3.214 (4)	126
$\text{C6}-\text{H6A} \cdots \text{O5}^{\text{ii}}$	0.99	2.55	3.495 (4)	160
$\text{C11}-\text{H11} \cdots \text{O5}^{\text{iii}}$	0.95	2.55	3.191 (4)	125
$\text{C12}-\text{H12C} \cdots \text{O4}^{\text{iv}}$	0.98	2.49	3.270 (5)	137
$\text{C13}-\text{H13A} \cdots C_g$	0.98	3.36	4.116 (5)	136

Symmetry codes: (i)  $-x+1, -y+1, -z+1$ ; (ii)  $x-1, y, z$ ; (iii)  $-x+1, -y, -z+1$ ; (iv)  $x, -y+\frac{1}{2}, z+\frac{1}{2}$ .

Data collection: *SMART* (Bruker, 2000); cell refinement: *SAINT-Plus* (Bruker, 2000); data reduction: *SAINT-Plus*; program(s) used to solve structure: *SHELXS97* (Sheldrick, 2008); program(s) used to refine structure: *SHELXL97* (Sheldrick, 2008); molecular graphics: *DIAMOND* (Brandenburg, 2005); software used to prepare material for publication: *SHELXTL* (Sheldrick, 2008).

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Supplementary data and figures for this paper are available from the IUCr electronic archives (Reference: SJ5353).

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## supplementary materials

*Acta Cryst.* (2013). E69, m575–m576 [doi:10.1107/S1600536813026585]

**Bis[ $\mu$ -*N*-(pyridin-2-ylmethyl)pyridin-3-amine- $\kappa^2$ N:N']disilver(I) bis(perchlorate) dimethyl sulfoxide disolvate**

**Suk-Hee Moon and Ki-Min Park**

### 1. Comment

In the development of silver(I) coordination polymers with fascinating structures, numerous symmetrical dipyriddy ligands with nitrogen donor atoms in the same positions on the two terminal pyridines are employed due to their easy synthesis (Lee *et al.*, 2012; Leong & Vittal, 2011; Park *et al.*, 2010). Despite the rapid growth in the Ag<sup>I</sup> coordination chemistry, however, the investigation of Ag<sup>I</sup> coordination polymers using unsymmetrical dipyriddy ligands with nitrogen donor atoms on different positions in the two terminal pyridines still remains lacking (Moon *et al.*, 2013; Zhang *et al.*, 2013). Herein, we report the crystal structure of the title compound prepared by the reaction of silver(I) perchlorate with the unsymmetrical dipyriddy ligand *N*-(pyridine-3-ylmethyl)pyridine-2-amine. This was synthesized by the reaction of 2-aminopyridine and 3-pyridinecarboxaldehyde according to literature procedures (Foxon *et al.*, 2002; Lee *et al.*, 2008).

The binuclear cation of the title compound, [Ag<sub>2</sub>(C<sub>11</sub>H<sub>11</sub>N<sub>3</sub>)<sub>2</sub>](ClO<sub>4</sub>)<sub>2</sub>(C<sub>2</sub>H<sub>6</sub>SO)<sub>2</sub>, is located on an inversion centre. Therefore, the asymmetric unit of the compound consists of an Ag<sup>I</sup> cation, an *N*-(pyridine-3-ylmethyl)pyridine-2-amine ligand, a perchlorate anion and a molecule of dimethyl sulfoxide (DMSO) solvent. The two Ag<sup>I</sup> centres, each in a geometry slightly distorted from linear [N–Ag–N 170.78 (9)°], are coordinated by two pyridine N atoms from the two symmetry-related *N*-(pyridine-3-ylmethyl)pyridine-2-amine ligands, leading to the formation of a centrosymmetric 16-membered cyclic dimer (Fig. 1). The two pyridine rings coordinated to each Ag<sup>I</sup> centre are almost perpendicular to each other [dihedral angle = 87.73 (10)°]. Moreover, each Ag<sup>I</sup> centre in the cyclic dimer interacts weakly with the N atom of a secondary amine group [Ag1...N3 2.699 (3) Å] and the O atom of a DMSO solvent molecule and a ClO<sub>4</sub><sup>−</sup> anion [Ag1...O5 2.686 (3) Å and Ag1...O2 3.149 (3) Å] (Fig. 1).

In the crystal structure, the cyclic units interact with the ClO<sub>4</sub><sup>−</sup> anions and the DMSO solvent molecules *via* intermolecular N–H...O and C–H...O hydrogen-bonds and C–H... $\pi$  interactions (Table 1, Fig. 1). These interactions lead to the construction of a three-dimensional supramolecular network (Fig. 2).

### 2. Experimental

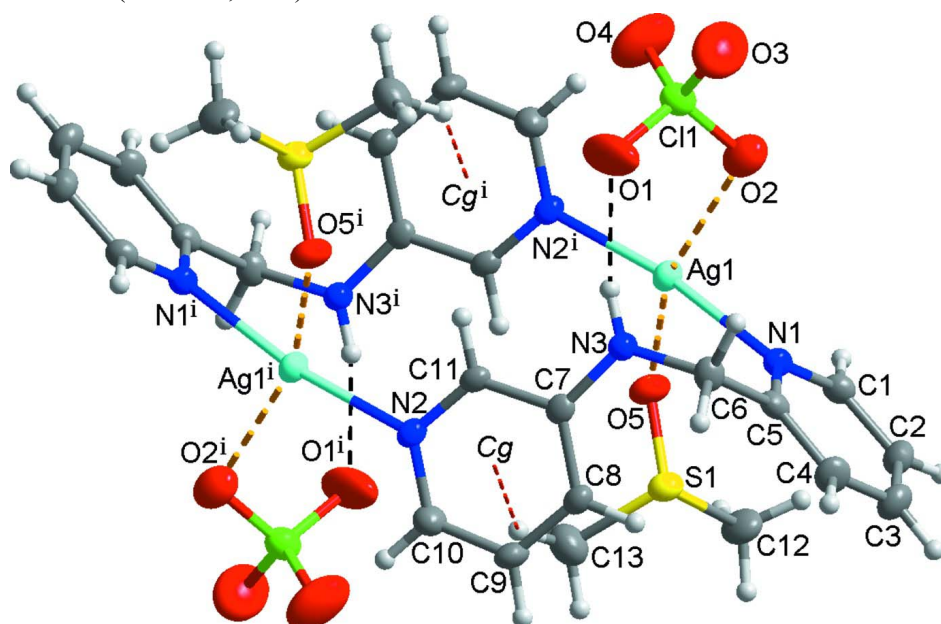
The ligand (*N*-(pyridin-3-ylmethyl)pyridine-2-amine) was prepared according to a procedure described by Foxon *et al.* (2002) and Lee *et al.* (2008). Crystals of the title compound suitable for X-ray analysis were obtained by vapor diffusion of diethyl ether into a DMSO solution of the white precipitate afforded by the reaction of the ligand with silver(I) perchlorate in the molar ratio 1:1 in methanol.

### 3. Refinement

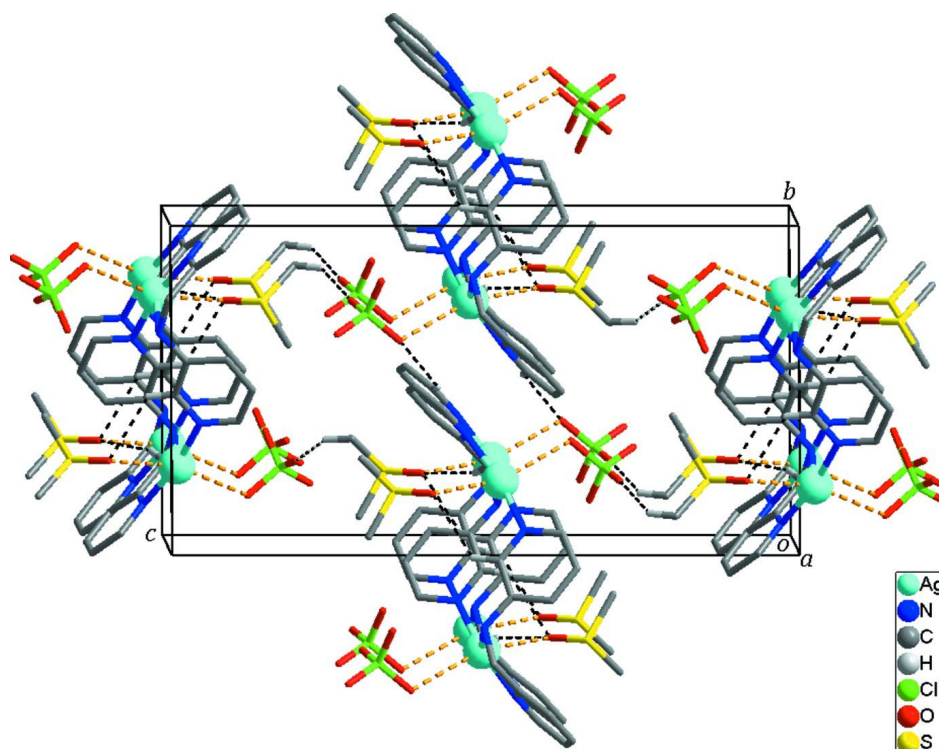
All H atoms were positioned geometrically and refined using a riding model, with d(C–H) = 0.95 Å for Csp<sup>2</sup>–H, 0.88 Å for amine N–H, 0.98 Å for methyl C–H and 0.99 Å for methylene C–H. For all H atoms  $U_{\text{iso}}(\text{H}) = 1.2U_{\text{eq}}(\text{C}, \text{N})$ .

**Computing details**

Data collection: *SMART* (Bruker, 2000); cell refinement: *SAINT-Plus* (Bruker, 2000); data reduction: *SAINT-Plus* (Bruker, 2000); program(s) used to solve structure: *SHELXS97* (Sheldrick, 2008); program(s) used to refine structure: *SHELXL97* (Sheldrick, 2008); molecular graphics: *DIAMOND* (Brandenburg, 2005); software used to prepare material for publication: *SHELXTL* (Sheldrick, 2008).

**Figure 1**

A view of the molecular structure of the title compound, with displacement ellipsoids drawn at the 50% probability level. Intermolecular Ag $\cdots$ O interactions, N–H $\cdots$ O hydrogen bonds and C–H $\cdots\pi$  interactions are shown as yellow, black and red dashed lines, respectively. [Symmetry code: (i) 1 - x, - y, 1 - z].



**Figure 2**

The three-dimensional supramolecular structure formed through intermolecular Ag $\cdots$ O (yellow dashed lines) and C–H $\cdots$ O interactions (black dashed lines).

**Bis[ $\mu$ -N-(pyridin-2-ylmethyl)pyridin-3-amine- $\kappa^2$ N:N']disilver(I) bis(perchlorate) dimethyl sulfoxide disolvate**

*Crystal data*

[Ag<sub>2</sub>(C<sub>11</sub>H<sub>11</sub>N<sub>3</sub>)<sub>2</sub>](ClO<sub>4</sub>)<sub>2</sub>·2C<sub>2</sub>H<sub>6</sub>OS

$M_r$  = 941.35

Monoclinic,  $P2_1/c$

Hall symbol: -P 2ybc

$a$  = 7.3620 (3) Å

$b$  = 11.1227 (5) Å

$c$  = 21.1248 (10) Å

$\beta$  = 95.328 (1)°

$V$  = 1722.34 (13) Å<sup>3</sup>

$Z$  = 2

$F(000)$  = 944

$D_x$  = 1.815 Mg m<sup>-3</sup>

Mo  $K\alpha$  radiation,  $\lambda$  = 0.71073 Å

Cell parameters from 7360 reflections

$\theta$  = 2.7–28.3°

$\mu$  = 1.48 mm<sup>-1</sup>

$T$  = 173 K

Block, colorless

0.45 × 0.20 × 0.20 mm

*Data collection*

Bruker SMART CCD area-detector  
diffractometer

Radiation source: fine-focus sealed tube

Graphite monochromator

$\varphi$  and  $\omega$  scans

9537 measured reflections

3367 independent reflections

3096 reflections with  $I > 2\sigma(I)$

$R_{\text{int}}$  = 0.049

$\theta_{\text{max}}$  = 26.0°,  $\theta_{\text{min}}$  = 1.9°

$h$  = -9→8

$k$  = -13→13

$l$  = -25→18

# Refinement

Refinement on  $F^2$ 

Least-squares matrix: full

 $R[F^2 > 2\sigma(F^2)] = 0.033$ 
 $wR(F^2) = 0.086$ 
 $S = 1.02$ 

3367 reflections

217 parameters

0 restraints

Primary atom site location: structure-invariant  
direct methods

Secondary atom site location: difference Fourier  
map

Hydrogen site location: inferred from  
neighbouring sites

H-atom parameters constrained

 $w = 1/[\sigma^2(F_o^2) + (0.0399P)^2 + 3.5438P]$ 

where  $P = (F_o^2 + 2F_c^2)/3$ 
 $(\Delta/\sigma)_{\max} = 0.001$ 
 $\Delta\rho_{\max} = 0.61 \text{ e } \text{\AA}^{-3}$ 
 $\Delta\rho_{\min} = -0.65 \text{ e } \text{\AA}^{-3}$ 

# Special details

**Geometry.** All e.s.d.'s (except the e.s.d. in the dihedral angle between two l.s. planes) are estimated using the full covariance matrix. The cell e.s.d.'s are taken into account individually in the estimation of e.s.d.'s in distances, angles and torsion angles; correlations between e.s.d.'s in cell parameters are only used when they are defined by crystal symmetry. An approximate (isotropic) treatment of cell e.s.d.'s is used for estimating e.s.d.'s involving l.s. planes.

**Refinement.** Refinement of  $F^2$  against ALL reflections. The weighted  $R$ -factor  $wR$  and goodness of fit  $S$  are based on  $F^2$ , conventional  $R$ -factors  $R$  are based on  $F$ , with  $F$  set to zero for negative  $F^2$ . The threshold expression of  $F^2 > \sigma(F^2)$  is used only for calculating  $R$ -factors(gt) *etc.* and is not relevant to the choice of reflections for refinement.  $R$ -factors based on  $F^2$  are statistically about twice as large as those based on  $F$ , and  $R$ -factors based on ALL data will be even larger.

# Fractional atomic coordinates and isotropic or equivalent isotropic displacement parameters ( $\text{\AA}^2$ )

	<i>x</i>	<i>y</i>	<i>z</i>	$U_{\text{iso}}^*/U_{\text{eq}}$
Ag1	0.50109 (3)	0.25805 (2)	0.484406 (11)	0.02344 (10)
N1	0.3332 (3)	0.3841 (2)	0.53484 (12)	0.0200 (5)
N2	0.3266 (3)	−0.1183 (2)	0.55086 (12)	0.0200 (5)
N3	0.1611 (3)	0.1670 (2)	0.48358 (12)	0.0224 (5)
H3	0.2056	0.1604	0.4465	0.027*
C1	0.4183 (4)	0.4681 (3)	0.57264 (14)	0.0229 (6)
H1	0.5437	0.4832	0.5686	0.028*
C2	0.3334 (4)	0.5334 (3)	0.61688 (15)	0.0269 (7)
H2	0.3984	0.5924	0.6424	0.032*
C3	0.1510 (5)	0.5108 (3)	0.62316 (16)	0.0305 (7)
H3A	0.0886	0.5533	0.6536	0.037*
C4	0.0616 (4)	0.4257 (3)	0.58450 (17)	0.0288 (7)
H4	−0.0639	0.4096	0.5879	0.035*
C5	0.1546 (4)	0.3632 (3)	0.54062 (14)	0.0201 (6)
C6	0.0546 (4)	0.2732 (3)	0.49703 (16)	0.0240 (6)
H6A	−0.0562	0.2469	0.5164	0.029*
H6B	0.0145	0.3135	0.4563	0.029*
C7	0.1930 (4)	0.0766 (3)	0.52826 (14)	0.0186 (6)
C8	0.1501 (4)	0.0853 (3)	0.59090 (15)	0.0231 (6)
H8	0.0907	0.1548	0.6051	0.028*
C9	0.1955 (5)	−0.0089 (3)	0.63220 (15)	0.0275 (7)
H9	0.1657	−0.0049	0.6750	0.033*
C10	0.2841 (4)	−0.1091 (3)	0.61127 (15)	0.0265 (7)
H10	0.3156	−0.1727	0.6402	0.032*
C11	0.2807 (4)	−0.0285 (3)	0.51076 (14)	0.0187 (6)
H11	0.3090	−0.0362	0.4680	0.022*

Cl1	0.22314 (10)	0.27926 (7)	0.31521 (4)	0.02713 (18)
O1	0.1356 (6)	0.1764 (3)	0.33725 (17)	0.0789 (13)
O2	0.2542 (4)	0.3637 (3)	0.36785 (14)	0.0448 (7)
O3	0.1082 (5)	0.3355 (4)	0.26650 (16)	0.0698 (10)
O4	0.3925 (5)	0.2503 (3)	0.2927 (2)	0.0716 (12)
S1	0.60059 (11)	0.23249 (7)	0.65444 (4)	0.02617 (18)
O5	0.7044 (3)	0.2308 (2)	0.59577 (12)	0.0329 (5)
C12	0.7185 (5)	0.3371 (3)	0.70810 (17)	0.0378 (8)
H12A	0.6999	0.4189	0.6915	0.045*
H12B	0.8491	0.3184	0.7123	0.045*
H12C	0.6709	0.3312	0.7498	0.045*
C13	0.6627 (6)	0.0977 (4)	0.6968 (2)	0.0435 (9)
H13A	0.6077	0.0285	0.6736	0.052*
H13B	0.6187	0.1013	0.7392	0.052*
H13C	0.7958	0.0893	0.7011	0.052*

*Atomic displacement parameters ( $\text{\AA}^2$ )*

	$U^{11}$	$U^{22}$	$U^{33}$	$U^{12}$	$U^{13}$	$U^{23}$
Ag1	0.02007 (14)	0.02377 (15)	0.02746 (16)	0.00319 (8)	0.00743 (10)	−0.00257 (9)
N1	0.0173 (12)	0.0213 (12)	0.0218 (13)	0.0015 (9)	0.0038 (9)	0.0011 (10)
N2	0.0171 (12)	0.0227 (12)	0.0201 (12)	0.0000 (9)	0.0017 (9)	−0.0040 (10)
N3	0.0251 (13)	0.0213 (13)	0.0214 (13)	0.0007 (10)	0.0055 (10)	−0.0009 (10)
C1	0.0199 (14)	0.0255 (15)	0.0236 (15)	−0.0021 (12)	0.0026 (11)	0.0025 (12)
C2	0.0298 (17)	0.0243 (15)	0.0261 (16)	0.0005 (13)	0.0006 (13)	−0.0054 (13)
C3	0.0281 (17)	0.0325 (18)	0.0313 (17)	0.0059 (13)	0.0056 (13)	−0.0069 (14)
C4	0.0165 (14)	0.0332 (17)	0.0375 (18)	0.0030 (12)	0.0069 (13)	−0.0017 (15)
C5	0.0169 (13)	0.0212 (14)	0.0221 (15)	0.0008 (11)	0.0013 (11)	0.0061 (12)
C6	0.0170 (14)	0.0236 (15)	0.0310 (17)	0.0014 (11)	0.0010 (12)	−0.0006 (13)
C7	0.0134 (13)	0.0206 (14)	0.0216 (14)	−0.0032 (10)	0.0004 (10)	−0.0035 (11)
C8	0.0237 (15)	0.0227 (15)	0.0237 (15)	−0.0005 (12)	0.0064 (12)	−0.0050 (12)
C9	0.0332 (18)	0.0316 (17)	0.0187 (14)	0.0039 (13)	0.0077 (12)	−0.0018 (13)
C10	0.0292 (16)	0.0281 (16)	0.0221 (15)	0.0026 (13)	0.0016 (12)	0.0026 (13)
C11	0.0145 (13)	0.0238 (14)	0.0183 (14)	−0.0020 (11)	0.0041 (10)	−0.0031 (11)
Cl1	0.0197 (4)	0.0316 (4)	0.0305 (4)	−0.0007 (3)	0.0042 (3)	0.0034 (3)
O1	0.127 (3)	0.064 (2)	0.0482 (19)	−0.056 (2)	0.023 (2)	−0.0070 (17)
O2	0.0408 (15)	0.0491 (16)	0.0449 (16)	−0.0090 (12)	0.0067 (12)	−0.0133 (13)
O3	0.067 (2)	0.082 (3)	0.055 (2)	0.0250 (19)	−0.0210 (16)	0.0001 (18)
O4	0.0364 (18)	0.107 (3)	0.073 (3)	0.0121 (17)	0.0135 (17)	−0.029 (2)
S1	0.0257 (4)	0.0319 (4)	0.0210 (4)	0.0002 (3)	0.0030 (3)	−0.0023 (3)
O5	0.0330 (13)	0.0431 (14)	0.0235 (12)	0.0003 (10)	0.0071 (10)	−0.0045 (10)
C12	0.046 (2)	0.041 (2)	0.0263 (17)	−0.0081 (17)	0.0023 (15)	−0.0101 (15)
C13	0.051 (2)	0.036 (2)	0.043 (2)	−0.0006 (17)	0.0024 (18)	0.0077 (17)

*Geometric parameters ( $\text{\AA}$ ,  $^\circ$ )*

Ag1—N2 <sup>i</sup>	2.181 (2)	C7—C8	1.392 (4)
Ag1—N1	2.208 (2)	C7—C11	1.402 (4)
N1—C1	1.345 (4)	C8—C9	1.385 (4)
N1—C5	1.352 (4)	C8—H8	0.9500

N2—C11	1.332 (4)	C9—C10	1.384 (4)
N2—C10	1.346 (4)	C9—H9	0.9500
N2—Ag1 <sup>i</sup>	2.181 (2)	C10—H10	0.9500
N3—C7	1.384 (4)	C11—H11	0.9500
N3—C6	1.460 (4)	Cl1—O4	1.412 (3)
N3—H3	0.8800	Cl1—O1	1.413 (3)
C1—C2	1.379 (4)	Cl1—O3	1.416 (3)
C1—H1	0.9500	Cl1—O2	1.457 (3)
C2—C3	1.385 (5)	S1—O5	1.515 (3)
C2—H2	0.9500	S1—C13	1.784 (4)
C3—C4	1.377 (5)	S1—C12	1.791 (4)
C3—H3A	0.9500	C12—H12A	0.9800
C4—C5	1.389 (4)	C12—H12B	0.9800
C4—H4	0.9500	C12—H12C	0.9800
C5—C6	1.506 (4)	C13—H13A	0.9800
C6—H6A	0.9900	C13—H13B	0.9800
C6—H6B	0.9900	C13—H13C	0.9800
N2 <sup>i</sup> —Ag1—N1	170.78 (9)	C9—C8—C7	118.9 (3)
C1—N1—C5	118.0 (3)	C9—C8—H8	120.5
C1—N1—Ag1	118.47 (19)	C7—C8—H8	120.5
C5—N1—Ag1	121.8 (2)	C10—C9—C8	120.1 (3)
C11—N2—C10	118.6 (3)	C10—C9—H9	120.0
C11—N2—Ag1 <sup>i</sup>	115.99 (18)	C8—C9—H9	120.0
C10—N2—Ag1 <sup>i</sup>	124.9 (2)	N2—C10—C9	121.5 (3)
C7—N3—C6	121.0 (3)	N2—C10—H10	119.3
C7—N3—H3	119.5	C9—C10—H10	119.3
C6—N3—H3	119.5	N2—C11—C7	123.6 (3)
N1—C1—C2	123.6 (3)	N2—C11—H11	118.2
N1—C1—H1	118.2	C7—C11—H11	118.2
C2—C1—H1	118.2	O4—Cl1—O1	111.7 (3)
C1—C2—C3	118.3 (3)	O4—Cl1—O3	110.0 (3)
C1—C2—H2	120.8	O1—Cl1—O3	109.7 (3)
C3—C2—H2	120.8	O4—Cl1—O2	108.8 (2)
C4—C3—C2	118.8 (3)	O1—Cl1—O2	108.34 (19)
C4—C3—H3A	120.6	O3—Cl1—O2	108.1 (2)
C2—C3—H3A	120.6	O5—S1—C13	105.98 (17)
C3—C4—C5	120.1 (3)	O5—S1—C12	105.90 (16)
C3—C4—H4	119.9	C13—S1—C12	98.13 (19)
C5—C4—H4	119.9	S1—C12—H12A	109.5
N1—C5—C4	121.2 (3)	S1—C12—H12B	109.5
N1—C5—C6	119.0 (3)	H12A—C12—H12B	109.5
C4—C5—C6	119.8 (3)	S1—C12—H12C	109.5
N3—C6—C5	114.6 (2)	H12A—C12—H12C	109.5
N3—C6—H6A	108.6	H12B—C12—H12C	109.5
C5—C6—H6A	108.6	S1—C13—H13A	109.5
N3—C6—H6B	108.6	S1—C13—H13B	109.5
C5—C6—H6B	108.6	H13A—C13—H13B	109.5
H6A—C6—H6B	107.6	S1—C13—H13C	109.5



N3—C7—C8	124.0 (3)	H13A—C13—H13C	109.5
N3—C7—C11	118.6 (3)	H13B—C13—H13C	109.5
C8—C7—C11	117.3 (3)		
C5—N1—C1—C2	0.2 (4)	C4—C5—C6—N3	−143.6 (3)
Ag1—N1—C1—C2	−165.1 (2)	C6—N3—C7—C8	−9.0 (4)
N1—C1—C2—C3	0.5 (5)	C6—N3—C7—C11	173.9 (3)
C1—C2—C3—C4	−0.9 (5)	N3—C7—C8—C9	−177.2 (3)
C2—C3—C4—C5	0.7 (5)	C11—C7—C8—C9	0.0 (4)
C1—N1—C5—C4	−0.4 (4)	C7—C8—C9—C10	0.8 (5)
Ag1—N1—C5—C4	164.3 (2)	C11—N2—C10—C9	−0.3 (4)
C1—N1—C5—C6	177.6 (3)	Ag1 <sup>i</sup> —N2—C10—C9	170.8 (2)
Ag1—N1—C5—C6	−17.7 (4)	C8—C9—C10—N2	−0.7 (5)
C3—C4—C5—N1	0.0 (5)	C10—N2—C11—C7	1.2 (4)
C3—C4—C5—C6	−178.0 (3)	Ag1 <sup>i</sup> —N2—C11—C7	−170.7 (2)
C7—N3—C6—C5	75.8 (3)	N3—C7—C11—N2	176.4 (3)
N1—C5—C6—N3	38.4 (4)	C8—C7—C11—N2	−1.0 (4)

Symmetry code: (i)  $-x+1, -y, -z+1$ .

### Hydrogen-bond geometry ( $\text{\AA}$ , $^\circ$ )

Cg is the centroid of the N2/C7–C11 pyridine ring.

$D-H\cdots A$	$D-H$	$H\cdots A$	$D\cdots A$	$D-H\cdots A$
N3—H3 $\cdots$ O1	0.88	2.32	3.081 (4)	144
C1—H1 $\cdots$ O2 <sup>ii</sup>	0.95	2.56	3.214 (4)	126
C6—H6A $\cdots$ O5 <sup>iii</sup>	0.99	2.55	3.495 (4)	160
C11—H11 $\cdots$ O5 <sup>i</sup>	0.95	2.55	3.191 (4)	125
C12—H12C $\cdots$ O4 <sup>iv</sup>	0.98	2.49	3.270 (5)	137
C13—H13A $\cdots$ Cg	0.98	3.36	4.116 (5)	136

Symmetry codes: (i)  $-x+1, -y, -z+1$ ; (ii)  $-x+1, -y+1, -z+1$ ; (iii)  $x-1, y, z$ ; (iv)  $x, -y+1/2, z+1/2$ .